## REMARKS

Applicants thank Examiner Allen for the analysis set forth in the January 11, 2005 Office Action.

### Rejection under 35 U.S.C. § 103

Claims 1-5 presently stand rejected under 35 U.S.C. § 103 as being unpatentable over Robinson et al. in view of Hopfe et al.

The present invention contains pressure from a single direction. Seal group 18 contains the pressure from chamber 16, while seal group 24 is redundant and sits idle. As long as seal group 18 remains intact, pressure port 30 and sensor 32, indicate zero or very low pressure compared to the pressure in chamber 16 because the pressure port 30 is located on the low-pressure side of seal group 18, away from the critical pressure in chamber 16. Seal group 24 sees little or no pressure. As the system works, the seal group 18 may wear to the point of failure because it is containing the critical pressure from chamber 16 while the shaft 14 is moving. When seal group 18 fails, seal group 24 contains the critical pressure from chamber 16 and the pressure port 30 will be exposed to the higher pressure from chamber 16 because it is located on the high-pressure side of seal group 24. The sensor 32, attached to the pressure port 30, indicates when the seal group 24 is containing the critical pressure from chamber 16. The sensor 32 indication of pressure equal to chamber 16 means the seal group 18 has failed.

The present invention was developed for applications, such as blow out preventers, where the seals contain volatile fluids under thousands of pounds of pressure and the system cannot be simply taken off-line to check seal integrity. Seal failure results in blow out conditions, which can potentially lead to loss of the oil drilling rig and loss of life. The present invention is arranged to monitor the integrity of the primary seal group 18 continuously. An indication of primary seal group 18 failure through pressure port 30 and pressure sensor 32 does not mean a shut down. The system continues in useful operation by relying on the secondary seal grouping



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24 to contain critical pressure. Use must continue until time and conditions allow the blow out preventer to be taken off line for the replacement of the failed seal group 18.

Teachings of Robinson

In the Robinson patent, the bodies 16 and 124 containing primary seal 112 form a static seal configuration with no movable parts. Similarly body 16 and portion 118 of body 124 containing seal 114 forms a second static seal with no movable parts. The inlet port 102 supplies fuel that must flow through the fuel inlets 38 in body 16. Seal 112 provides a means to prevent fuel leakage out of the assembled unit. Seal 114 provides a means to prevent fuel flowing into the outlet 104 and bypassing the fuel regulator. In this arrangement, they are both static seals containing pressure between them from inlet 102. Detection of a failure of seal 112 would be through observation of fuel spillage outside of the body 124. Detection of a failure of seal 114 would be through observation of fuel bypassing the fuel regulator and exiting through outlet 104. The Robinson patent teaches a means to statically seal pressure between two seals contained between two bodies with a pressured fluid supplied to the space between the two seals. If either seals 112 or 114 fail, the pressure containment is lost and the system fails. Robinson does not have a "primary" and a "secondary" seal arrangement as those terms were intended in the claim language.

The seal arrangement of the present invention could be used to replace one seal in the Robinson system. If the present invention replaced seal 112 in the Robinson system, there would be an indication of a primary seal group 18 failure and sensor 32 attached to the pressure port 30 would inform the operator. The present invention would help prevent fuel spills when seal 112 of the Robinson system fails, as redundant secondary seal group 24 would assume the sealing function.



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Teachings of Hopfe

The arrangement in the Hopfe mechanism utilizes the engagement of the seal elements 52 and 54 with the cylinder 50. As the displacer 14 moves from chamber 46 into the cylinder 50, the seals 52 and 54 are compressed and the pressure in annular volume 60 increases if the seals 52 and 54 are inviolate. The system detects the pressure increase in volume 60 and must be maintained throughout the proving cycle to provide an accurate reading, (lines 41 to 67, column 5). The Hopfe system requires this compression of the seals 52 and 54 when they engage cylinder 50 and the resulting pressure increase in volume 60 to determine the integrity of the seals 52 and 54. The system will not operate properly without a detectable pressure increase.

The Hopfe seal assembly and detection system is designed for the detection of seal failure from two directions. The system, however, does not indicate which seal has failed or the condition of the seal failure. The Hopfe system is similar to the Robinson invention where the arrangement is seal 52, pressure in volume 60 and seal 54. In this case, the pressure is contained between the two seals 52 and 54. As explained above, this is not the case in the present invention.

The Hopfe mechanism is designed to measure flow by diverting the fluid stream into the prover 10 and timing the resulting travel of the displacer 14 through cylinder 50, (lines 16 to 22, column 5). The proving cycle may be less than 1/3 of a second. Due to the speed of the measurement, leaks from the displacer seals 52 and 54 could cause inaccuracies in the flow readings. Considering the time involved in the proving cycle, small inaccuracies due to leakage could result in substantial volume inaccuracies over longer periods, days, weeks, months or even years. For this reason, the seal integrity must be maintained throughout the prover cycle. Hopfe states a static method of checking seal 52 and 54 integrity for longer periods by positioning displacer 14 in cylinder 50, (lines 7 to 12, column 6). However, the bypass valve 30 must be



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open to allow the pipeline fluid to continue to flow. This observation method is equivalent to taking the flow prover system off-line to check the seal integrity. If either or both of the seals 52 or 54 have failed, the prover cannot continue in useful operation and must be dismantled for repair.

Summary

As noted by the Examiner, the Robinson and Hopfe patent references are capable of detecting seal failure. It is respectfully submitted, however, that there are significant differences. Seal grouping 24 of the present invention is redundant, it could be removed without altering the operation of the blow out preventer. Seal grouping 24 is shielded from critical pressure until seal grouping 18 fails, then seal grouping 24 takes over to permit the blow out preventer to continue operating, until drilling operations are over for the day, the well is contained and it is safe to remove the blow out preventer for servicing. The language of independent Claims 1 and 5 have been amended to better distinguish over the Robinson and Hopfe references, by clarifying what is meant by the term "primary" seal and the term "secondary" seal. The primary seal is now defined as being a seal that is <u>adapted to seal critical pressure coming from a single direction.</u> The secondary seal is now defined as being a <u>redundant</u> seal <u>serving no other purpose but to back up the primary seal in the event of failure of the primary seal.</u> The secondary seal is described as being <u>shielded from the critical pressure by the primary seal</u>, until such time as the primary seal fails.

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In view of the foregoing amendments and arguments, it is respectfully submitted that the present application is now in a condition for allowance. Applicants, therefore, request reconsideration and the issuance of a Notice of Allowance.

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Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the U.S. Postal Service in a sealed envelope as first class mail with postage thereon fully prepaid and addressed to **Mail Stop Amendment**, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the below date.

Date: April 11, 2005

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